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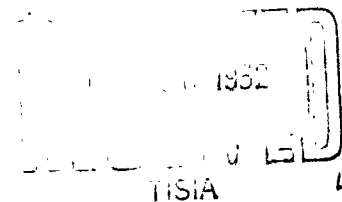
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MATERIALS - SILVER-COPPER-LITHIUM ALLOY -
17-7PH SANDWICH PANELS BRAZED WITH - EFFECTS
OF ELEVATED TEMPERATURE ON - STRUCTURAL
EVALUATION OF

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TEST DATA MEMORANDUM

W-TDM NO. 0205
MODEL B-58
TEST NO. F-8725

TEST: MATERIALS - SILVER-COPPER-LITHIUM BRAZING ALLOY - 17-7PH STAINLESS
PANELS BRAZED WITH - EFFECTS OF ELEVATED TEMPERATURE ON -
STRUCTURAL EVALUATION OF

OBJECT:

To evaluate the effect of oxidation in air at 700 F on stainless steel sandwich panels brazed with sterling silver plus 0.2% lithium.

TEST SPECIMENS & PROCEDURE:

A 1/2" x 13" x 25" sandwich panel was brazed with sterling silver + 0.2% Li brazing alloy. After brazing, the panel was vacuum purged with air ten times. It was cut into specimens as shown in Figure 1, and exposed as described in Table IIIa. The specimens were tested at room temperature on a 120,000 lb. Baldwin test machine. A second panel was brazed but not tested because of the results obtained from the first panel. Four 1/2" x 1" x 2" panel specimens were exposed as indicated in Table IIIb. These specimens were examined visually.

RESULTS & DISCUSSION:

The results of the mechanical tests are given in Tables I and II. Photomicrographs showing the extent of oxidation in the brazed fillet are shown in Figure 2. Contrary to expectation, the specimen strength was as good or better after exposure as it was before exposure. The high strength after exposure was probably due to additional precipitation hardening of the steel during exposure. A corrosion condition previously observed on PH15-7 Mo brazed panels was found on the 17-7PH stainless steel panels of this test. Corrosion occurred on the steel adjacent to the brazing alloy-steel interfaces. It was most evident on the outer edges of the exposed honeycomb core. The condition was not evident immediately after cooling to room temperature. It apparently developed as the specimens stood in the moist air of the laboratory. The corrosion appeared as small brown growths or scale. The cause was not determined.

CONCLUSIONS:

1. After exposure in air at 700 F for periods up to 300 hours, 17-7PH steel sandwich panels with adequate fillets, brazed with sterling silver + 0.2% Li, have strengths equal to or better than similar panels in the as-brazed condition.
2. A new type of corrosion of brazed 17-7PH stainless steel panels was observed during this investigation. The mechanism of attack was not determined.

APPROVED: D. C. Wilson
D. C. Wilson

DATE: 10/12/59

*See Supplemental Sheet S-1

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CUTTING DIAGRAM

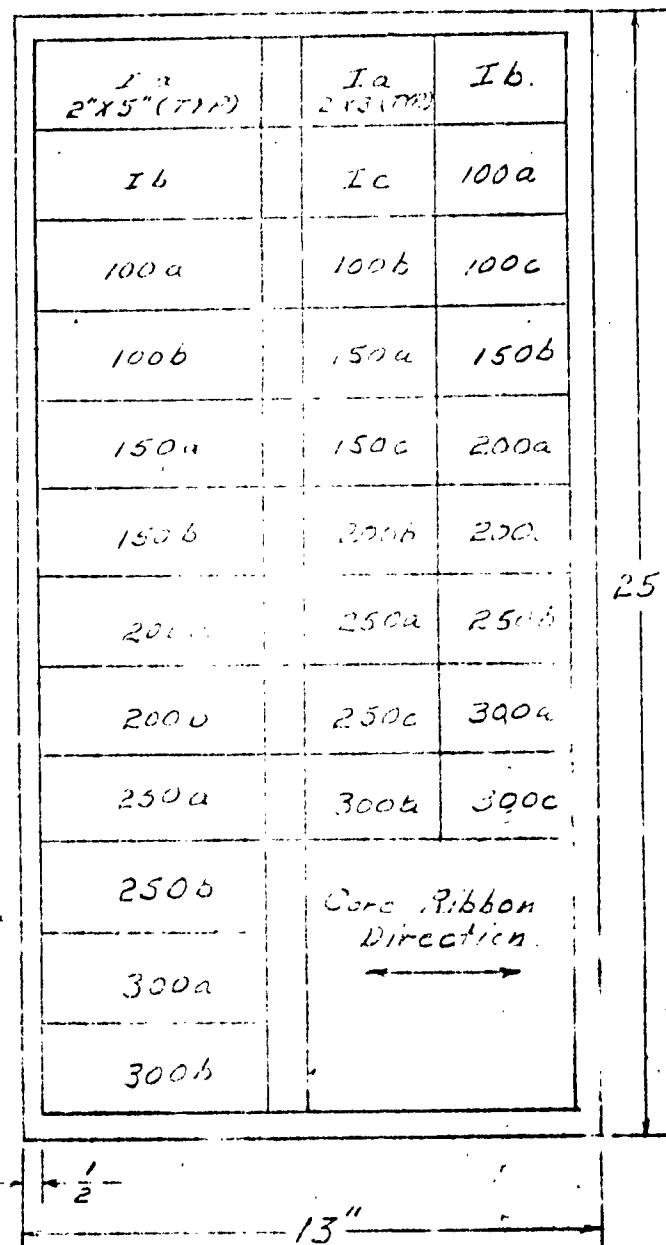


Figure-1

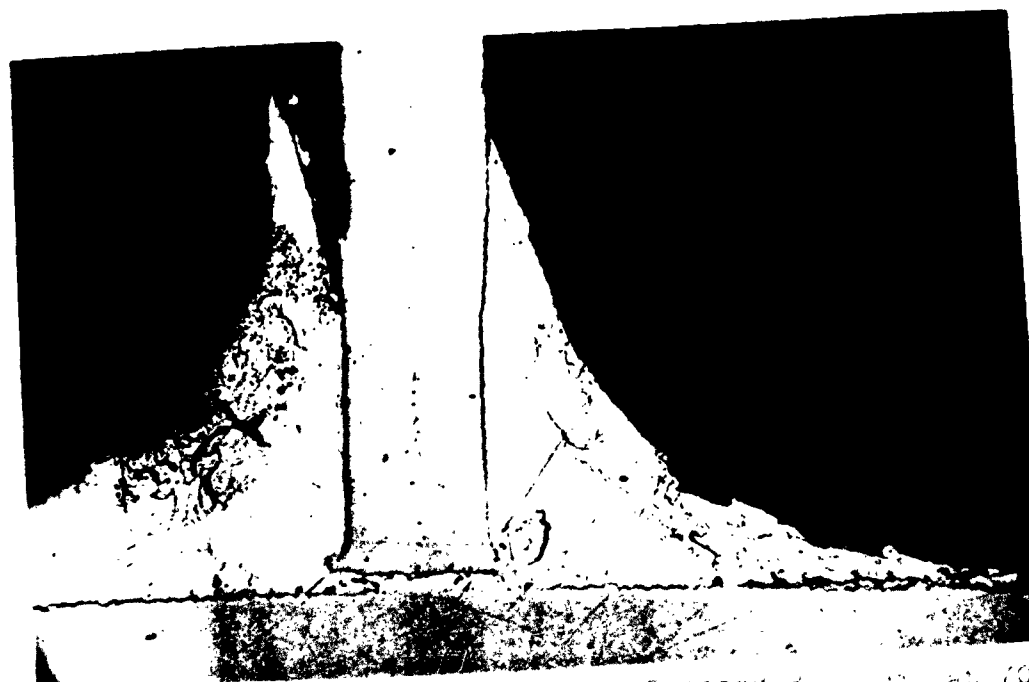
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A DIVISION OF GENERAL DYNAMICS CORPORATION
(FORT WORTH)

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Shear Beam Specimen Fillet. Exposed 300 hrs. at 700 F.
Approximate depth of oxidation in fillet - 0.05" Mag. 250X
Unetched.



Shear Beam Specimen Fillet. Exposed 300 hrs. at 700 F.
Approximate depth of oxidation in fillet - 0.05" Mag. 250X
Unetched.

Figure 2

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EDGE COMPRESSION VALUES FROM AIR
TABULATION SHEET EXPOSURE PANEL - BRAZED ON GRAPHITE

SAMP. NO.	HRS @ 700	TEST TEMP.	SKIN GAGE	ULT. K.S.I.	TYPE FAILURE
I - a	NONE	R.T.	0.010"	202.8	core-core
b				213.3	
c				202.0	
AVERAGE				205.4	
100 - a	100			202.5	core-core
b				223.6	
c				215.0	
AVERAGE				213.7	
150 - a	150			210.8	core-core
b				194.2	core-braze
c				211.5	core-core
AVERAGE				205.5	
200 - a	200			200.8	core-core
b				227.4	core-core
c				217.7	core-braze
AVERAGE				215.3	
250 - a	250			226.8	core-core
b				223.1	
c				215.5	
AVERAGE				221.8	
300 - a	300			222.6	core-core
b				224.9	
c				202.8	
AVERAGE				216.8	

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TABULATION SHEET

SHEAR BEAM VALUES FROM AIR EX-
POSURE PANEL — BRAZED ON GRAPHITE

SAMP NO	HRS @ 700°	TEST TEMP.	SKIN GAGE	SPAN	f _{sc} PSI	TYPE FAIL.
I-4 b AVG	NONE ↓	RT ↓	0.010 ↓	3" ↓	970 945 958	Core shear ↓
100a b AVG	100 ↓	↓	↓	↓	940 875 902	↓
150a b AVG	150 ↓	↓	↓	↓	1000 970 985	↓
200a b AVG	200 ↓	↓	↓	↓	975 925 950	↓
250a b AVG	250 ↓	↓	↓	↓	850 855 852	↓
300a b AVG	300 ↓	↓	↓	↓	1075 900 988	↓

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TABLE III
TABULATION SHEET LIST OF SPECIMENS & EXPOSURE CONDITIONS

SAMP. NO.	TIME HRS.	TEMP. DEG. F.	SECTION
100a	NONE	NONE	SECTION IIIa
b	100	700	
c	150	700	
200a	200	700	
b	250	700	
c	300	700	
300a	300	700	
416	100	650	SECTION IIIb
436	300	650	
417	100	700	
437	300	700	

SUPPLEMENTAL INFORMATION

The data presented in this report is supplemented with the following information:

A. The panels for these tests were brazed and processed in accordance with standard production procedures for B-58 panels. The brazing and heat treatment cycle was as follows:

1. Braze at $1665^{\circ}\text{F} \pm 25^{\circ}\text{F}$ for 10 minutes.
2. Cool to $1400^{\circ}\text{F} \pm 25^{\circ}\text{F}$ and hold for 90 minutes.
3. Cool to room temperature and refrigerate to -20°F ($+0^{\circ}\text{F}$, -10°F) as rapidly as possible and hold for at least 60 minutes.
4. Allow panel to return to room temperature and then age at $1050^{\circ}\text{F} \pm 10^{\circ}\text{F}$ for 90 minutes.
5. Cool to room temperature.

B. The preparation and testing procedures for the test specimens were as follows:

1. Edge compression Test

- a. Specimen size is 2.00" x 3.00" x panel thickness.
- b. All edges are filed and sanded smooth to remove nicks and saw cuts which might induce premature failure and are filed with a soft machinable plastic material.
- c. The 2.00" edges are machined square and parallel to a tolerance of ± 0.001 inch per lineal inch.
- d. The test machine loading head and platen are checked for parallelism and adjustments made to insure parallelism. Test specimens are placed in the machine with the 3.00" edges normal to the bearing surfaces.
- e. Testing is accomplished by applying a continuous load to the 2.00" edges at a rate of 8,000 pounds per minute until failure.

2. Shear Beam Test

- a. Specimen size is 2.00" x 5.00" x panel thickness.
- b. All edges are filed and sanded smooth to remove nicks and saw cuts which might induce premature failure. The 5.00" edges are filled with a soft plastic material.
- c. Specimens are tested and supported as a simple beam with a 3.00" span.
- d. A continuous load is applied at the center of the span at the rate of 500 pounds per minute until failure.